REMARKS

The Office examined claims 1-11 and rejected the same. With this paper, new claim 12 is added, and claims 1-11 are unchanged. The new claim is fully supported by the specification as filed. New claim 12 is supported by at least page 4, lines 20-22 of the specification as filed.

Rejections under 35 USC § 103

On page 2 of the Office action, claims 1-11 are rejected under 35 USC § 103 as being unpatentable over Kwong *et al.* (US 5,578,848) in view of Bhattacharyya (US 6,700,771).

Independent claim 1 recites a semiconductor capacitor in which, between a capacitor dielectric including praseodymium oxide and a capacitor electrode formed from at least a first semiconductor layer including silicon, is a first thin intermediate layer serving as a diffusion barrier for oxygen. The Office asserts that Kwong teaches such a semiconductor capacitor, except for including praseodymium oxide in the dielectric, and relies on Bhattacharyya for such a teaching (Referring to column 11, lines 59-60.)

Claim 1 is patentable over Kwong in view of Bhattacharyya

There is no motivation to combine the praseodymium oxide dielectric disclosed in Bhattacharyya with the semiconductor capacitor disclosed by Kwong. The prior art must suggest the desirability of the combination. (See MPEP § 706.02(j).) Kwong discloses using dielectric layers of varying compositions to form a capacitor dielectric, while Bhattacharyya discloses using a praseodymium oxide dielectric. There is no suggestion from either reference that it is desirable to combine a dielectric that includes praseodymium oxide with a thin intermediate layer between a dielectric and a semiconductor capacitor electrode.

A thin intermediate layer between the semiconductor capacitor electrode is used in the present invention in order to reduce the amount of mixed oxide formed on the dielectric, because the dielectric constant is reduced in the mixed oxide as compared to praseodymium oxide. (See Specification page 3, lines 3-14.) The mixed oxide is formed when praseodymium oxide is deposited on a capacitor electrode containing silicon. (See Specification page 2, lines 30-33.) Therefore, the present invention seeks to obtain the full electrical advantages of having a dielectric that includes praseodymium oxide by including a thin intermediate layer between a semiconductor capacitor electrode and a dielectric.

There is no motivation to combine a praseodymium oxide dielectric from Bhattacharyya with a thin intermediate layer from Kwong, because without a praseodymium oxide dielectric there is no need for a thin intermediate layer to reduce mixed oxide formation. The teaching or suggestion to make the claimed combination cannot be based on the applicant's disclosure. (See MPEP § 706.02(j).)

Kwong does not suggest that one of the layers used to form the disclosed dielectric will prevent mixed oxide formation when a dielectric that includes praseodymium oxide is combined with a semiconductor capacitor electrode. Kwong only teaches creating a dielectric from Si_3N_5 and oxynitride layers, (see column 1, lines 51-54) and no mention is made of including praseodymium oxide in the dielectric. Without the presence of praseodymium oxide, no mixed oxide forms. Therefore, Kwong does not provide a suggestion to include a thin intermediate layer between a semiconductor capacitor electrode and a praseodymium oxide, because Kwong would not need to address the problem of mixed oxide formation.

Furthermore, a praseodymium oxide dielectric is used in Bhattacharyya specifically because of its high capacitance, and

there is no suggestion that additional layers should be used to maintain this high capacitance. (See column 6, lines 63-67 & column 7, lines 1-4.) Bhattacharyya does not suggest that there are problems associated with the use of praseodymium oxide in the dielectric. Therefore, one of ordinary skill in the art would not find motivation from Bhattacharrya to combine a praseodymium dielectric with a thin intermediate layer. Without a teaching or suggestion that it is desirable to make the claimed combination, references must not be combined.

Accordingly, applicant respectfully requests that the rejection under 35 USC § 103 to independent claim 1 be withdrawn, as well as the rejections to claims 2-11, in view of their dependencies.

New Claim 12 is patentable

New claim 12 is dependent from claim 1 and presents a semiconductor conductor capacitor having a first semiconductor layer that includes silicon which forms a first capacitor electrode, a second capacitor electrode, a capacitor dielectric including praseodymium oxide between the capacitor electrodes, and a thin intermediate layer composed of titanium between the capacitor dielectric the first semiconductor layer.

The primary reference Kwong does not disclose a semiconductor capacitor that includes a thin intermediate layer composed of titanium. Applicant acknowledges that Kwong discloses a semiconductor capacitor, which includes a first capacitor electrode, a dielectric, and a second capacitor electrode. However, Kwong nowhere discloses a layer made from titanium. The layers of the dielectric in Kwong are composed of Si_3N_4 and oxynitride. (See column 2, lines 55-60.) Since Kwong fails to disclose a thin intermediate layer composed of titanium, Kwong does not disclose all of the limitations of claim 12.

In addition, Kwong and Bhattacharyya even if combined fail to teach or suggest a thin intermediate layer composed of titanium. The prior art references must teach or suggest all of the claim limitations. (See MPEP § 706.02(j).) Neither reference teaches or suggests a thin intermediate layer composed of titanium. The layers of the dielectric in Kwong are composed of Si_3N_4 and oxynitride, (see column 2, lines 55-60) and the thin layers discussed in Bhattacharyya are composed of silicon-rich-nitride or titanium nitride. (See column 6, lines 45-57.) New claim 12 requires a thin intermediate layer that is titanium. A layer of titanium nitride does not meet this limitation because the layer contains titanium and nitrogen. In addition, Bhattacharyya only teaches using a titanium nitride layer when the capacitor electrode is metal, which is a conductor. (See column 6, lines 53-56.) New claim 12 requires that the capacitor electrode be a semiconductor, and therefore not completely metal. Therefore, Bhattacharyya does not teach using a layer containing titanium with a semiconductor capacitor electrode, another limitation of claim 12. For the above discussed reasons, new claim 12 is neither disclosed nor suggested by the cited prior art references.

Conclusion

For all the foregoing reasons it is believed that all of the claims of the application are in condition for allowance and their passage to issue is earnestly solicited.

Respectfully submitted,

March 7, 2006
Date

Keith R. Obert
Registration No. 58,051

WARE, FRESSOLA, VAN DER SLUYS
& ADOLPHSON LLP
755 Main Street, P.O. Box 224
Monroe, CT 06468-0224

tel: (203) 261-1234
Cust. No.: 004955